



California Activities Addressing Greenhouse Gas Emissions

**“Climate Policy After Marrakech:
Towards Global Participation”**

East-West Center

Honolulu, Hawaii

September 4, 2003

**Terry Surles
California Energy Commission**



California in Context

- ★ **Size of the economy**

- ▲ Gross state product in 2000 was about \$1.35 trillion

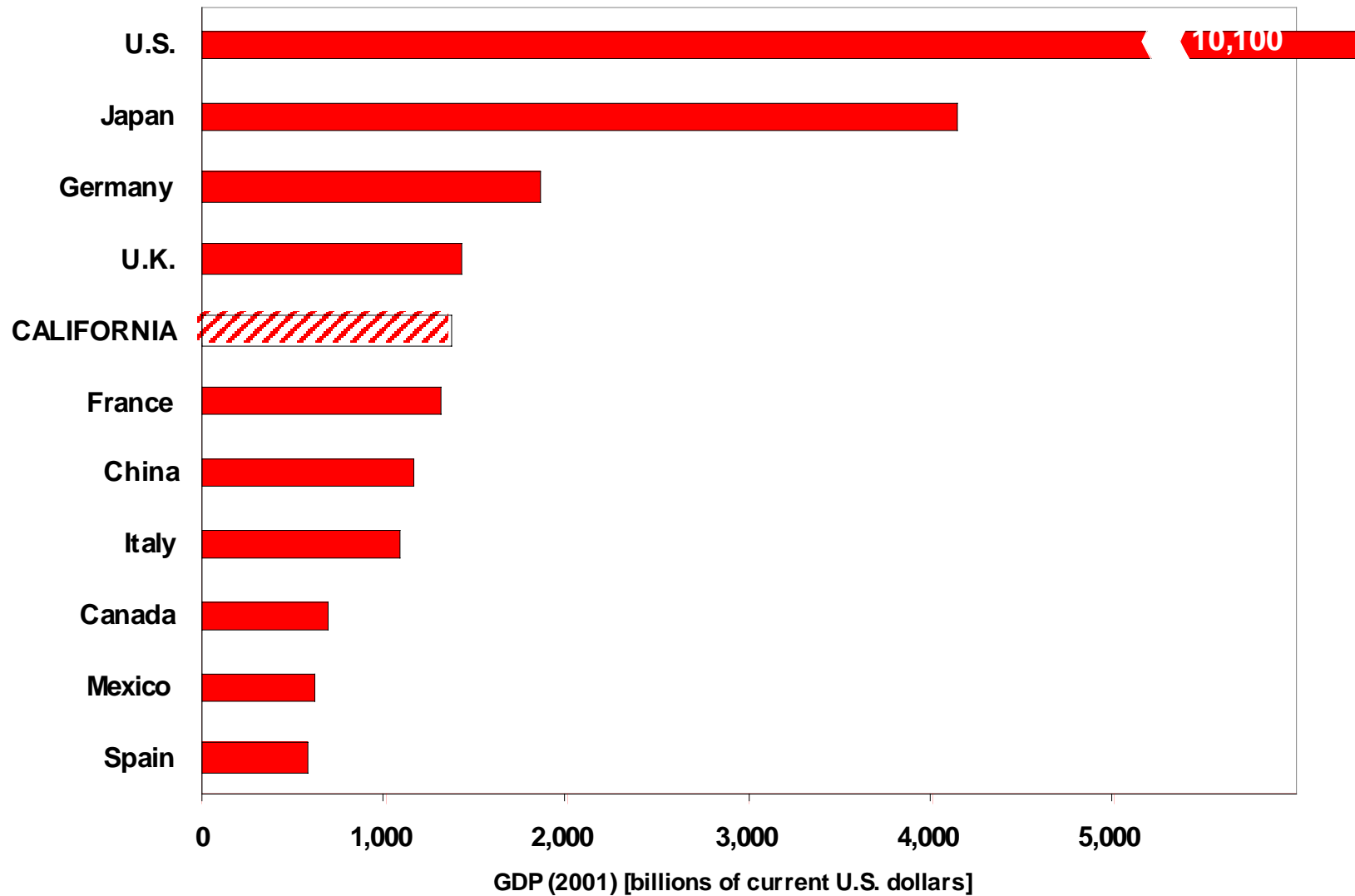
- ★ **Population**

- ▲ Population grew from about 30 million in 1990 to about 34.5 million in 2002

- ★ **History of encouraging economic growth, while maintaining an aggressive record for environmental protection**

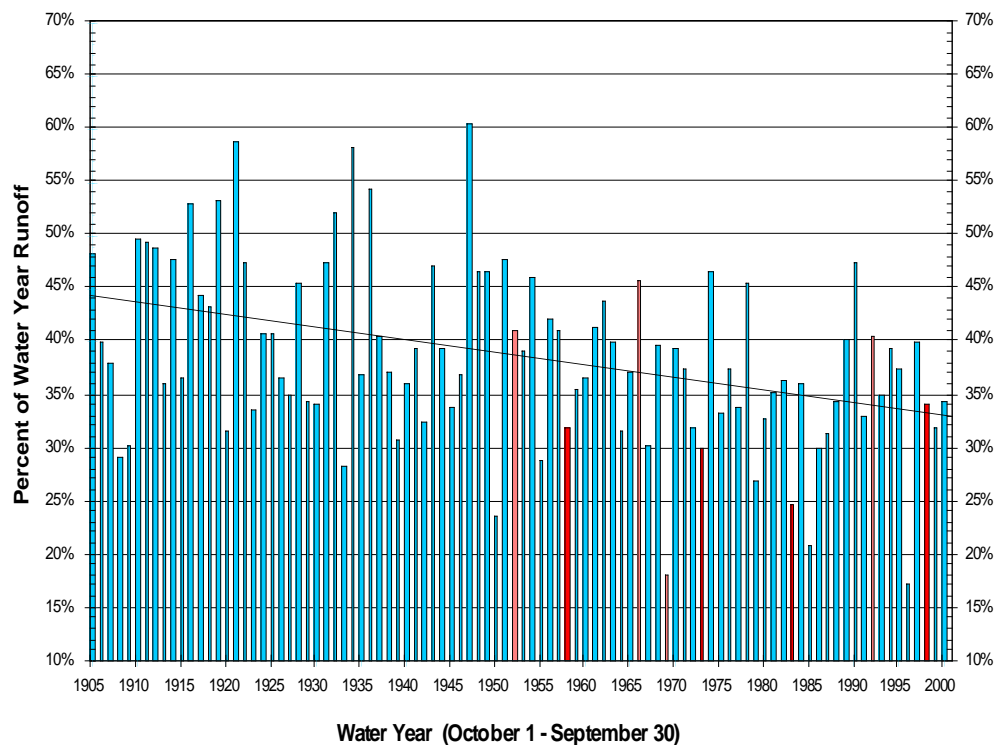


GDP (2001)





Our Principal Reservoir - The Sierra Snow Pack - Is Shrinking



*Sacramento River Runoff (1906-2001)
April to July as a Percent of Total Runoff*

Source: California Protection Agency, Environmental Protection Indicators for California, 2001

Warmer Winters Have:

- ★ Reduced snow pack
- ★ Earlier snow melt
- ★ Decreased Spring runoff by 10%
- ★ Major effects on water supply, Cal Fed and Delta



Potential Impacts of Climate Change on California: **Agriculture**

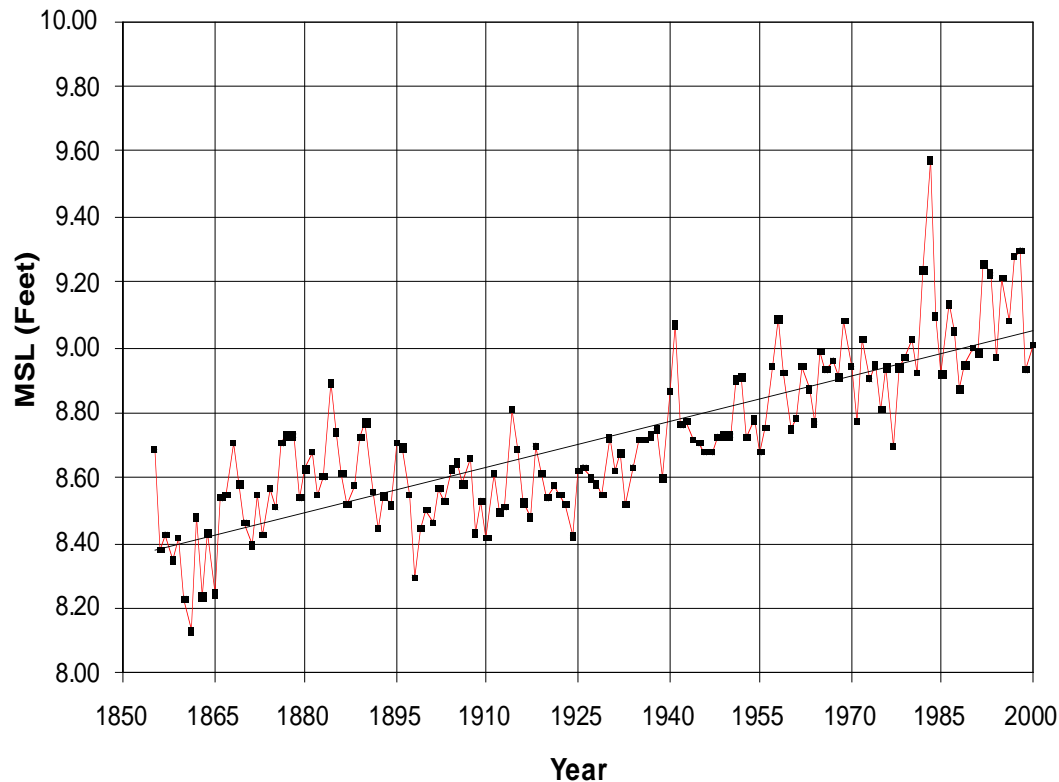
- ★ **Currently first in the nation in agricultural income**

- ▲ **major user of water; 43% of state total**
- ▲ **This sector may be severely affected by climate change but more studies are needed**
- ▲ **water availability: annual and seasonal**
- ▲ **exotic species**





Sea Level Is Rising Along California's Coast



*San Francisco Yearly Mean Sea Level
(1855-2000)*

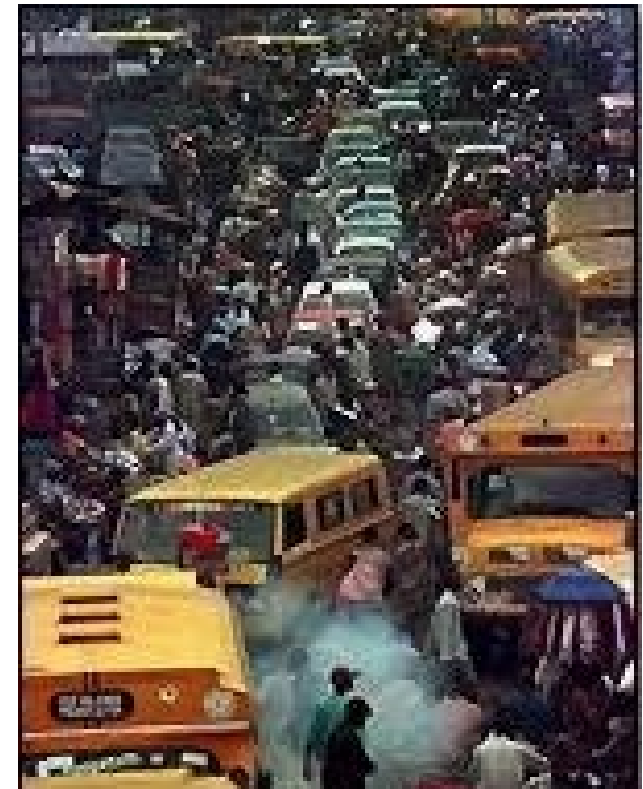
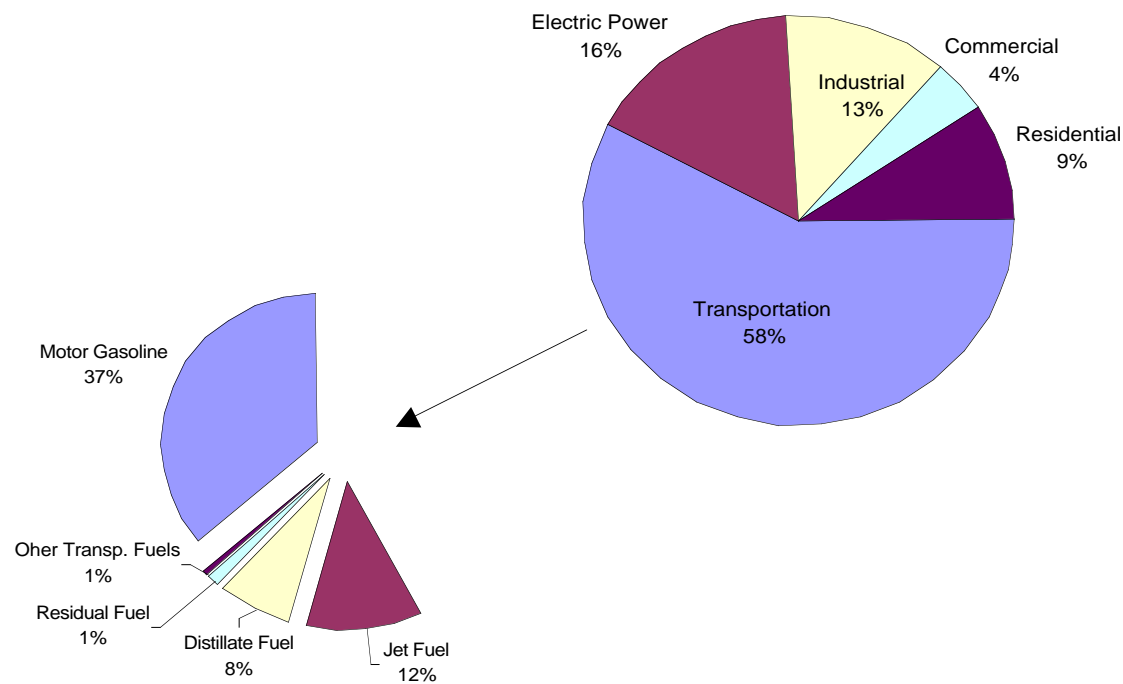
Source: California Protection Agency, Environmental Protection Indicators for California, 2001

- ★ CA has already seen a 7" rise in 150 years
- ★ IPCC projects 4-35" sea level rise by 2100
- ★ Concerns over levee stability and salt water intrusion



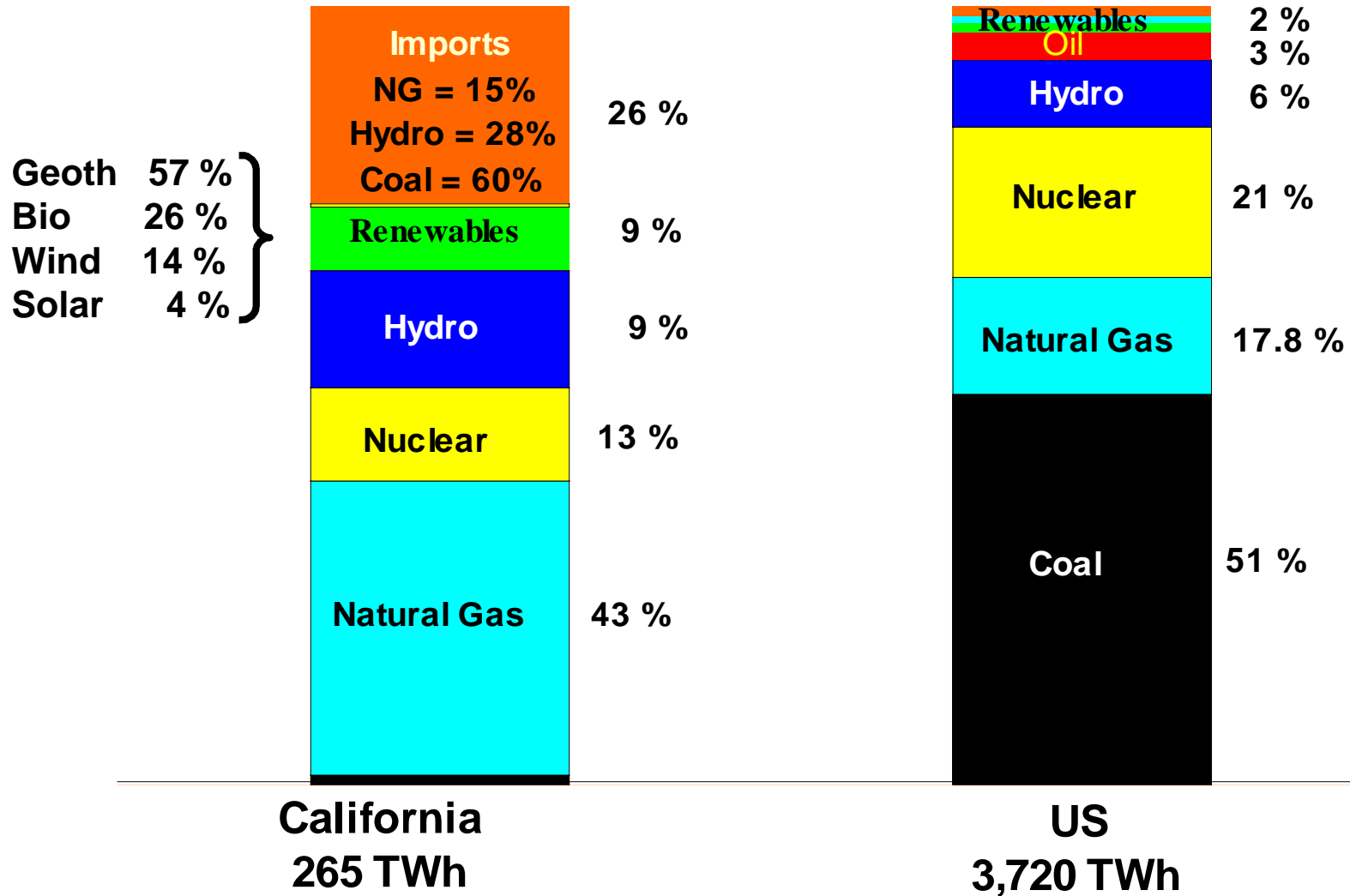
GHG Emission

In-State CO₂ Emissions by Sector (1999)



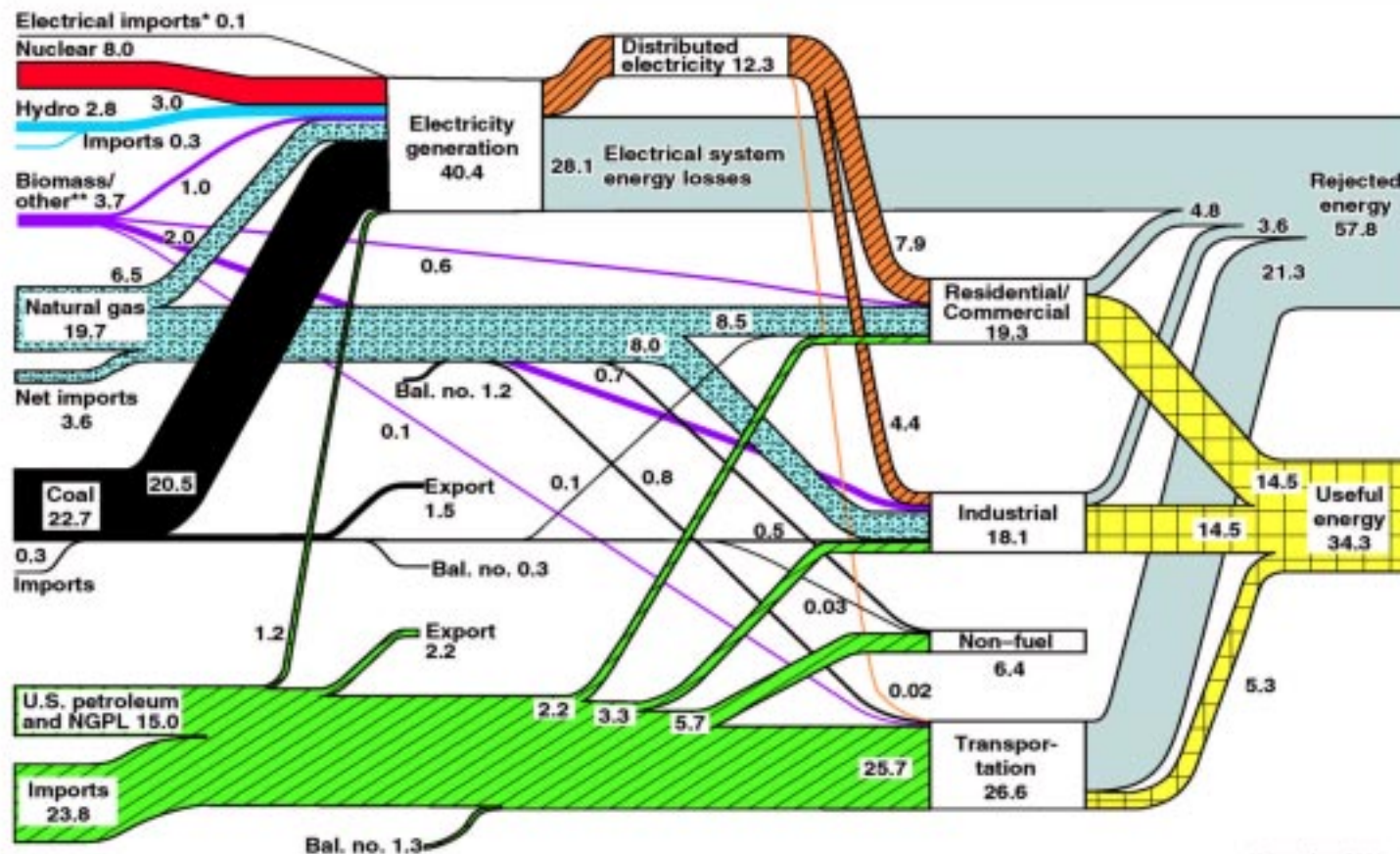


California vs US Electricity Supply 2001



U.S. Energy Flow Trends – 2000

Net Primary Resource Consumption 98.5 Quads



Source: Production and end-use data from Energy Information Administration, *Annual Energy Review 2000*

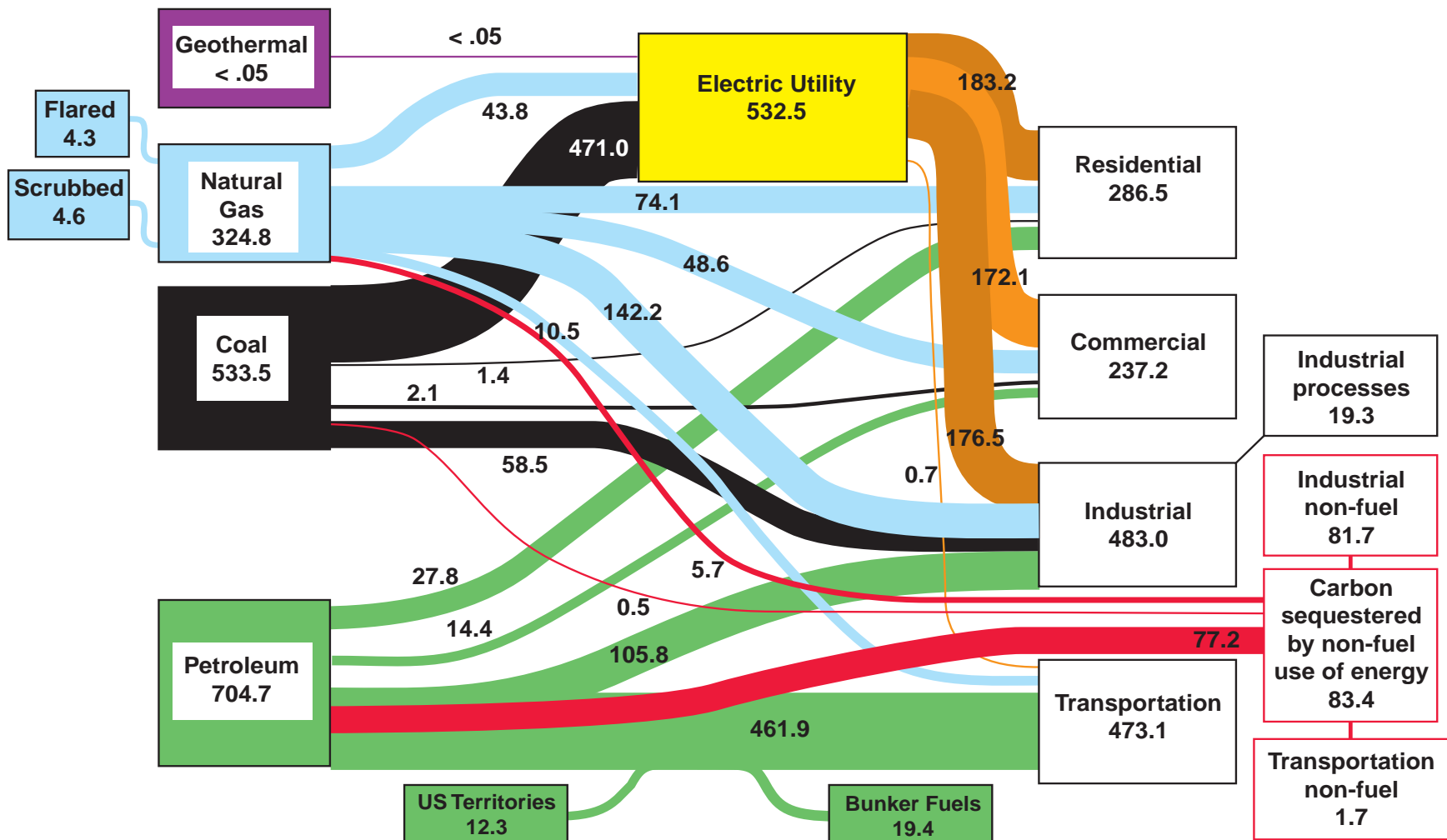
*Net fossil-fuel electrical imports

**Biomass/other includes wood and waste, geothermal, solar, and wind.

December 2001
Lawrence Livermore
National Laboratory

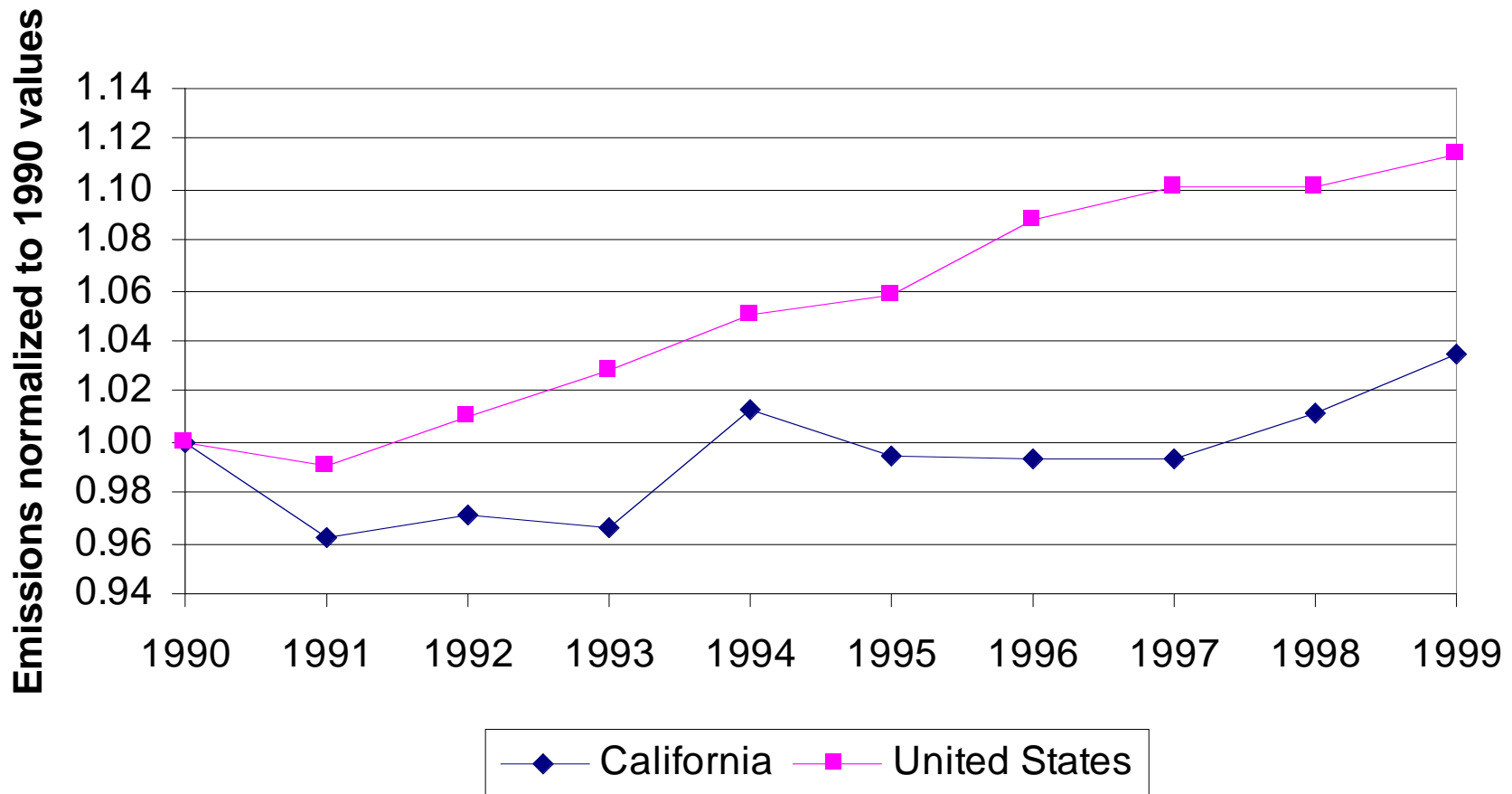


US 1997 Carbon Emissions: 1500 MtC





1990-1999 Relative Gross Greenhouse Gas Emissions





Existing State Policies/Programs/Initiatives

- ★ **Creation of a voluntary early action program (California Action Registry)**
- ★ **New carbon dioxide emission standard for cars projected to start in 2009**
- ★ **Renewable Energy Program**
- ★ **Efficiency Standards and Titles, e.g. Title 24 for buildings**
- ★ **Public Interest Energy Research Program**



Goals of the California Climate Action Registry

- ★ **Adopt protocols for reporting and certification of GHG emission reductions**
- ★ **Support credible, nationwide registry**
 - ▲ transparent and defensible results
 - ▲ extensive participation
- ★ **Influence global debate on registries**
- ★ **Assist development of GHG accounting, reporting and certification standards**



California Vehicular Emissions Reduction Bill



- ★ **Requires the California Air Resources Board to develop regulations that achieve the maximum feasible reduction of GHGs emitted by passenger vehicles and light trucks**
- ★ **The regulations will apply to the 2009 model years and thereafter**
- ★ **The bill provides automobile manufacturers with maximum flexibility**
- ★ **The bill offers numerous alternatives for GHG reductions**



Electricity Efficiency and Renewables in California



Goals of California Energy Action Plan 2003

- ★ **California kWh per capita is already flat compared to U.S. climbing 2% per year**
- ★ **New California goal is to reduce kWh per capita by 1% per year**
- ★ **Renewable Portfolio Standard: add 1% of renewables per year**
- ★ **Additional peak reduction of 1% per year by Demand Response when power is expensive or reliability is a problem**
- ★ **In total, goals aim to reduce electricity growth, increase renewables, grow demand response**



California

Renewable Portfolio Standard (2002)

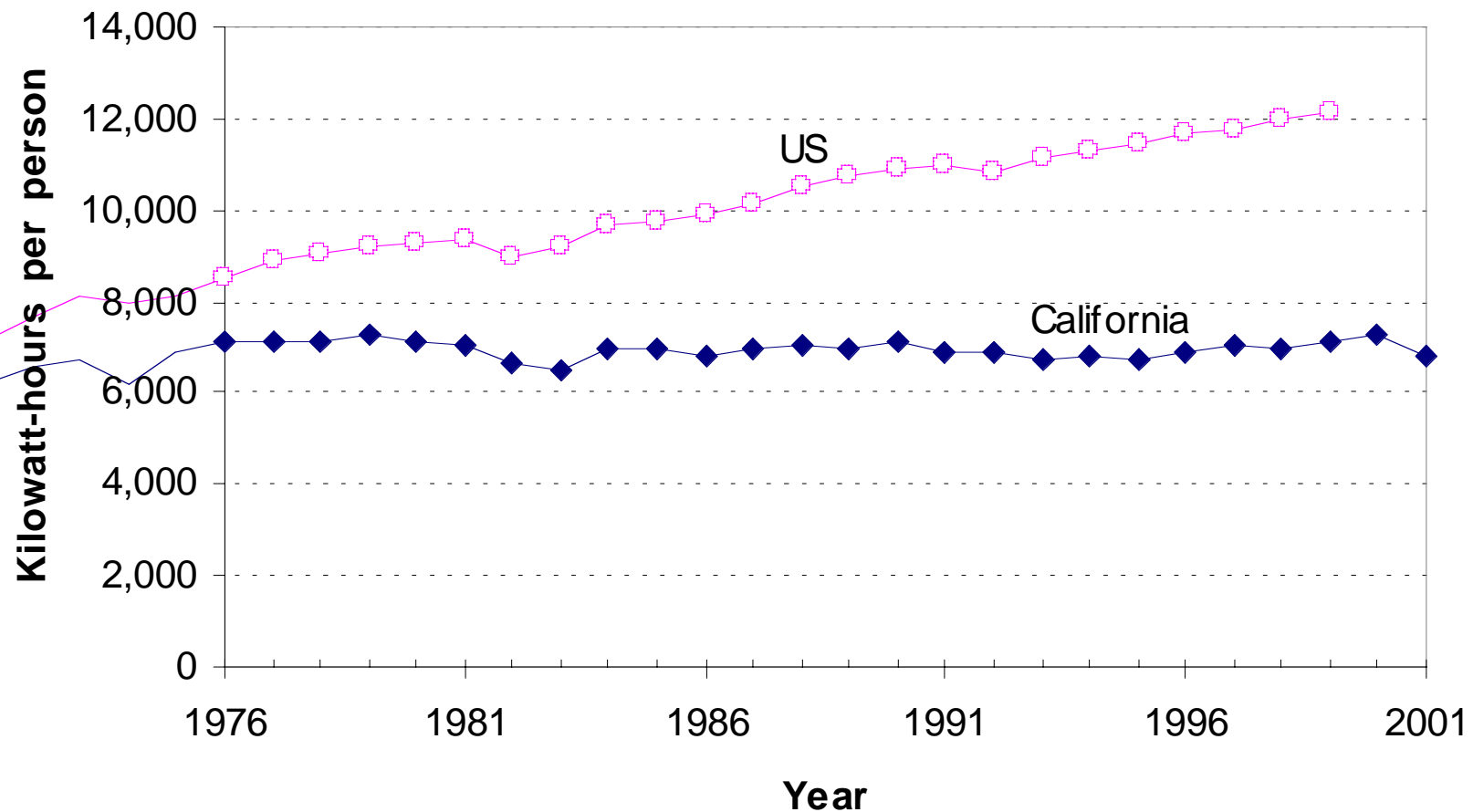


- ★ Requires utilities to increase renewable electricity by at least 1% per year to 2017, until 20% of retail sales are produced from renewables
- ★ Directs utilities to enter into contracts with renewable energy generators for at least 10 years duration
- ★ Requires the California Energy Commission to certify and fund renewable energy resources
- ★ Tied to current Public Goods Charge Program successes in existing QFs (biomass) and residential (PV)



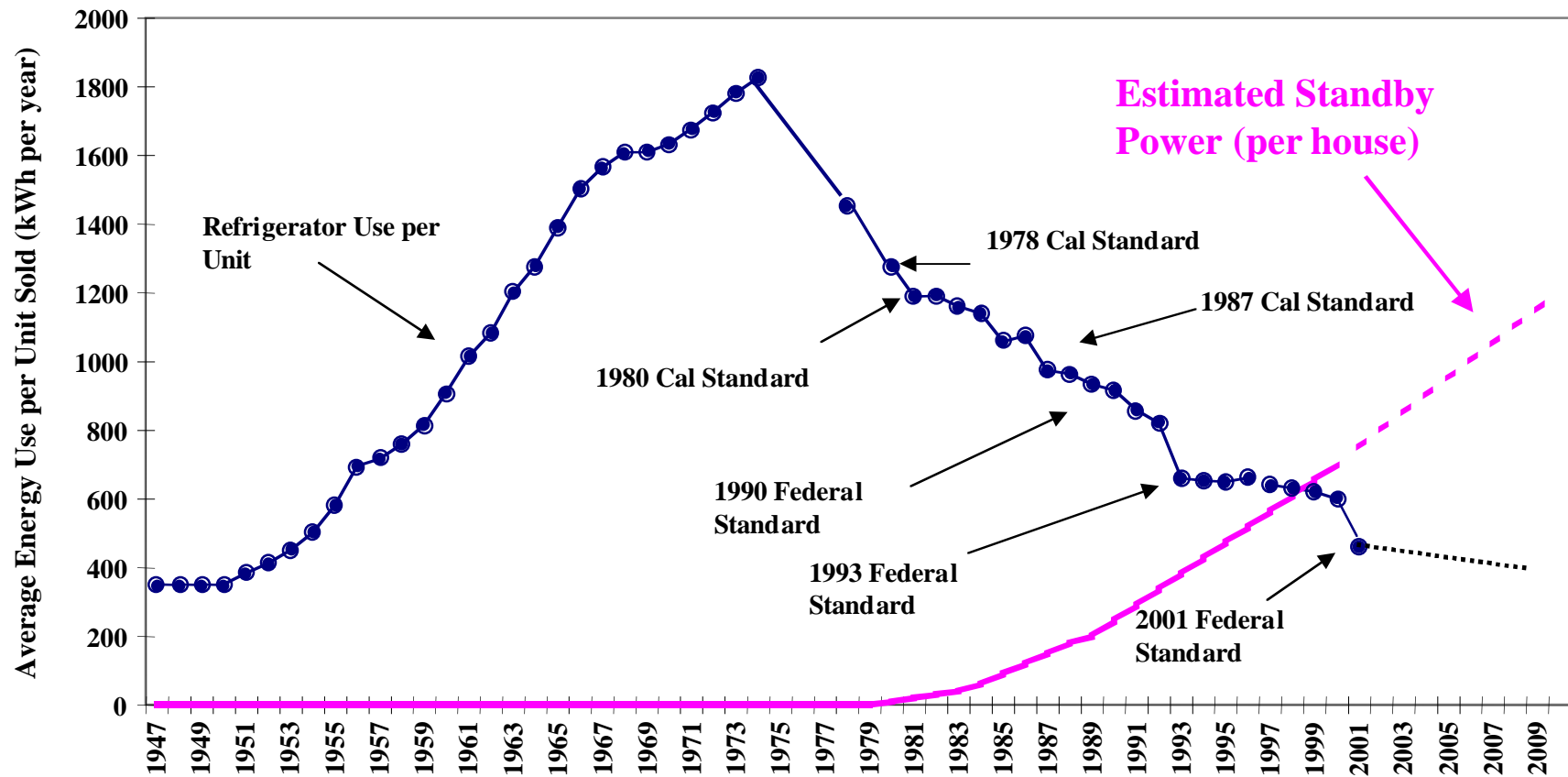


Per-Capita Electricity Consumption: Effect of California Energy Efficiency Programs



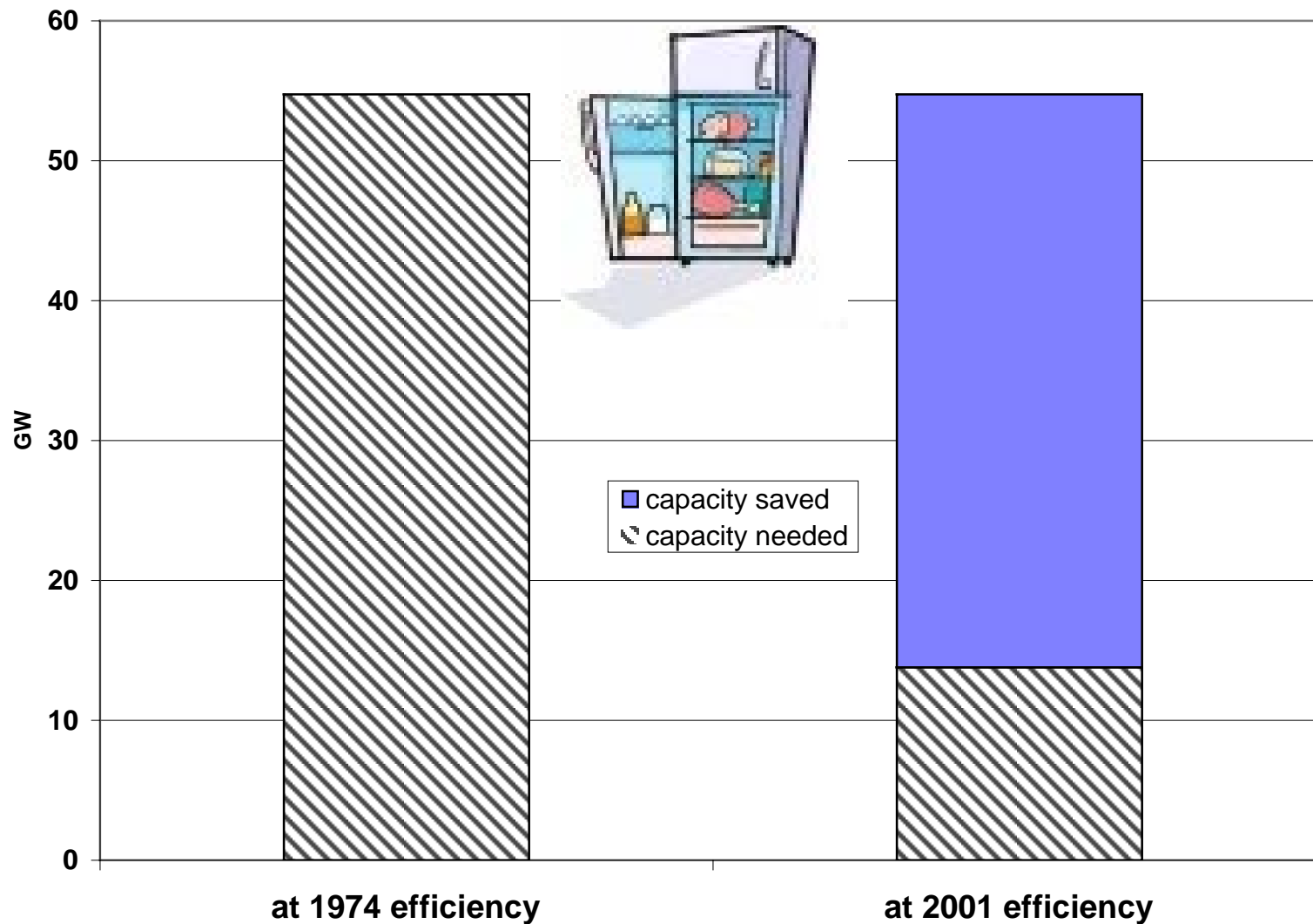


United States Refrigerator Use (Actual) And Estimated Household Standby Use v. Time



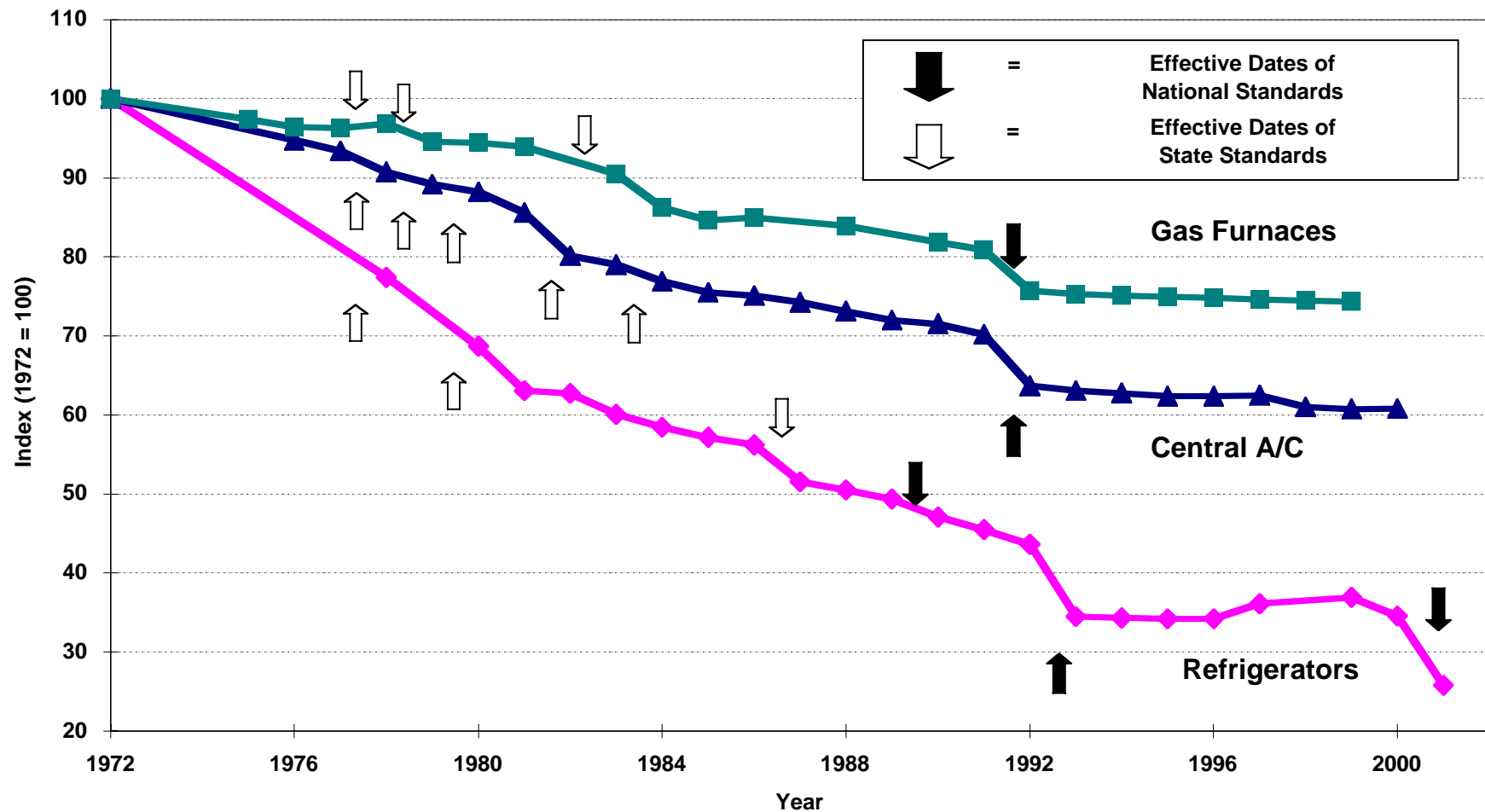


Electricity Generating Capacity for 150 Million Refrigerators + Freezers in the US





Impact of Standards on Efficiency of 3 Appliances

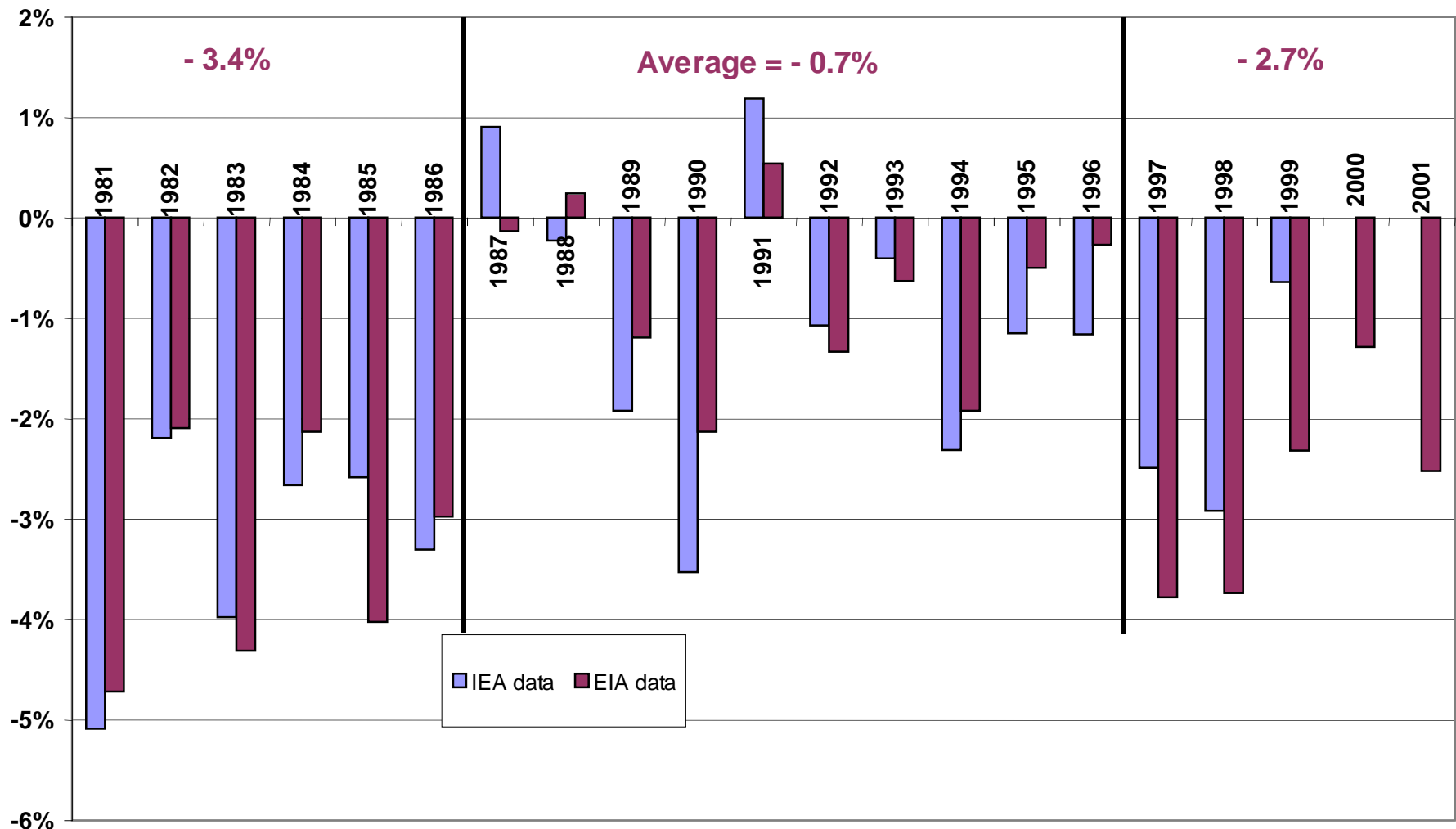




Annual Rate of Change in Energy/GDP for the United States



International Energy Agency (IEA) and EIA (Energy Information Agency)

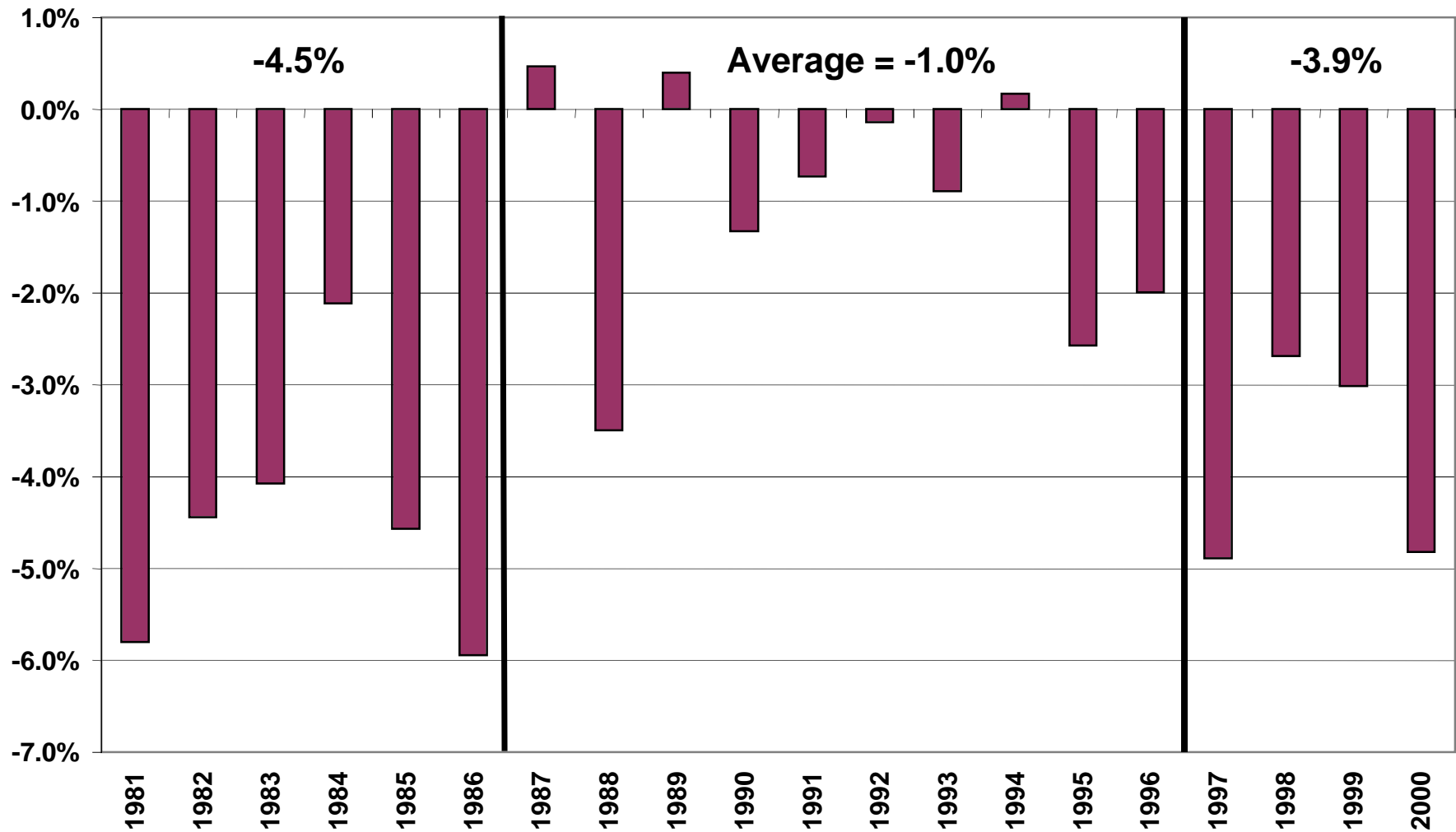




Annual Rate of Change in Energy/Gross State Product for California



(Sources: EIA and California Department of Finance)

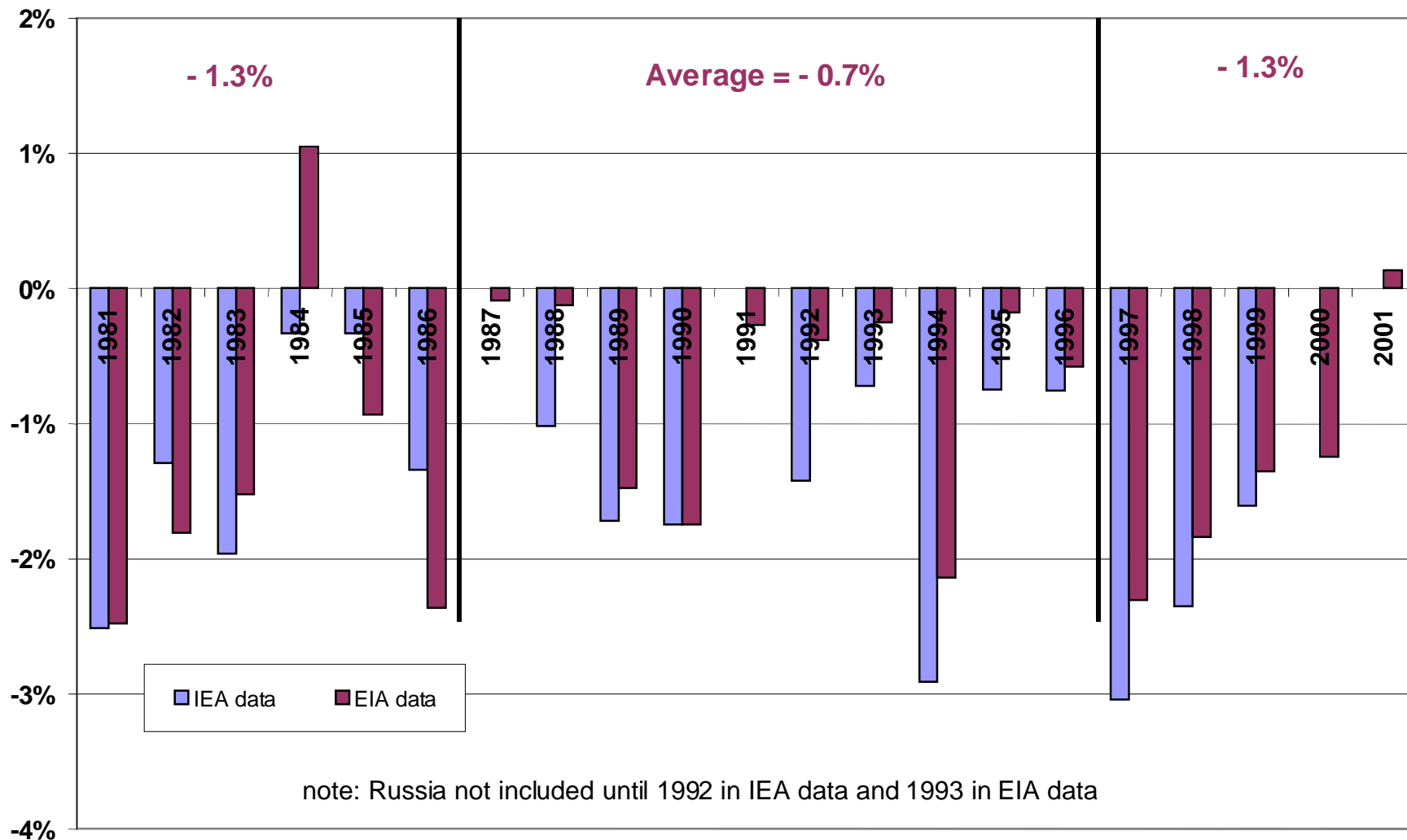




Annual Rate of Change in Energy/GDP for the World



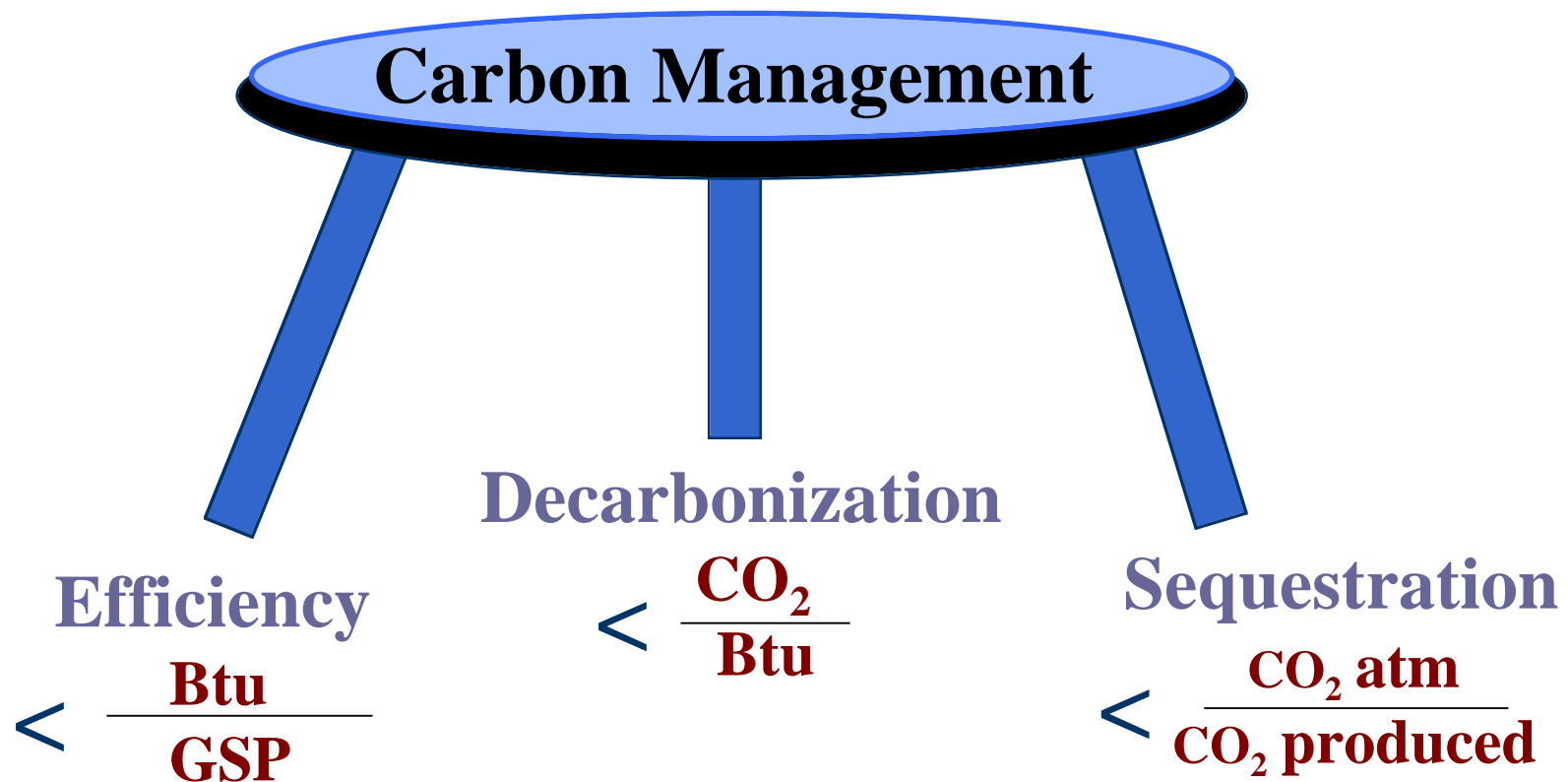
IEA (Energy/Purchasing Power Parity) and EIA (Energy/Market Exchange Rate)



note: Russia not included until 1992 in IEA data and 1993 in EIA data



California's R&D Program for Improving Efficiency and Developing Distributed Energy Resources





Berkeley Lamp

- * **Model partnership between CEC/DOE/California utilities**
 - ▲ PIER was instrumental in moving the technology into the marketplace via coordination with the Utility Emerging Technology Coordinating Council
 - ▲ Growing use in California and Hawaii



<http://www.energy.ca.gov/pier/pr.html>

Project is both a technical success and a customer success

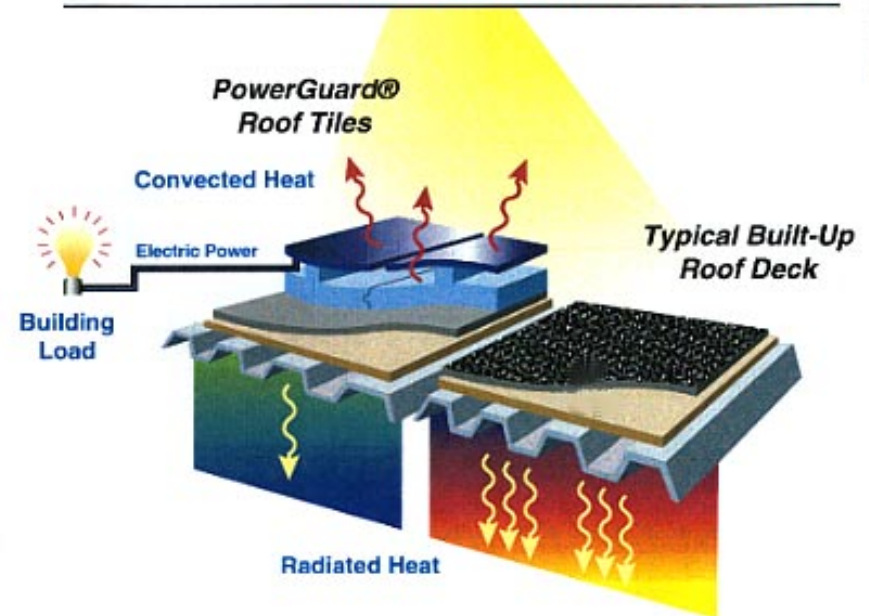


PowerLight's PowerGuard



While California is known for its hot dry summers, that same solar resource provides a clean, safe and reliable way to generate electricity

PowerGuard® - Power Generation & HVAC Savings



PowerLight's insulated 30 year roof system reduces building air conditioning loads while it's PV surface generates electricity during hot and expensive peak summer hours



The Yolo County Success



Accomplishments

- ▲ Is opening the way for landfill gas electricity systems to be more widely used in California
 - Accelerates gas production from over 30 years to less than 10 years, making landfill electricity more competitive
 - Reduces volume of landfill which can extend landfill life by 20 percent
 - Significantly reduces the chance for groundwater pollution from leachate release
- ▲ Has become the leading bioreactor project within EPA's XL Program and will strongly influence landfill regulations across the country

CEC's Role

- ▲ Through the CEC's R&D programs, we're bringing bioreactor technology from concept to reality



Control cell without bioreactor



Enhanced bioreactor cell



Xonon Cool Combustion System - Catalytica Energy Systems, Inc.

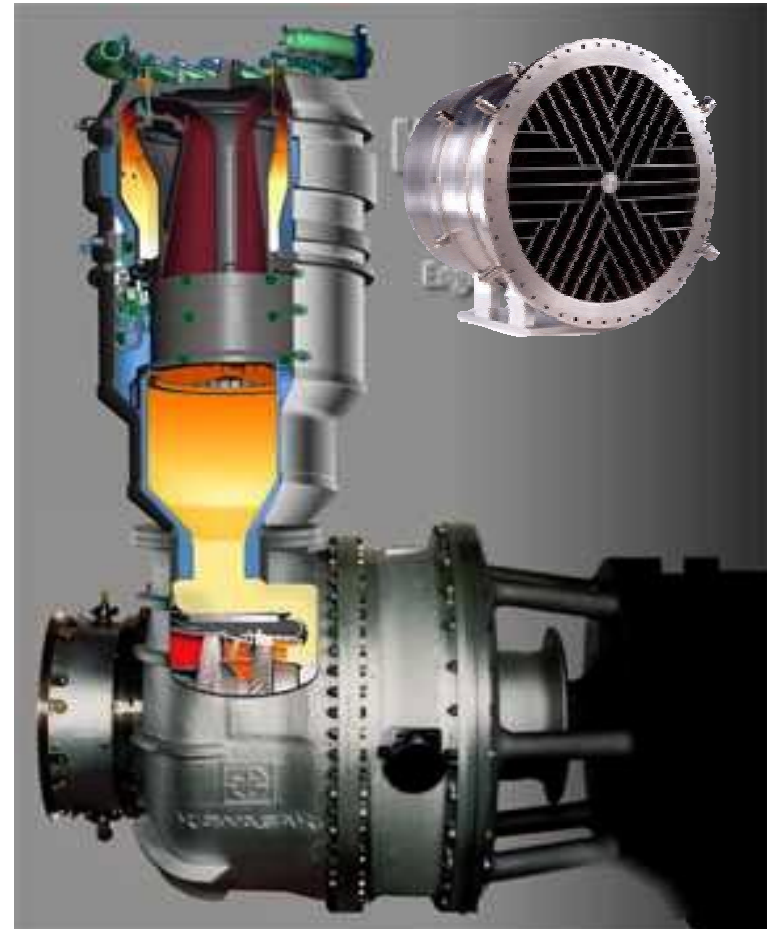


Description:

- * Gas turbine combustion system that controls combustion temperature to prevent the formation of NO_x

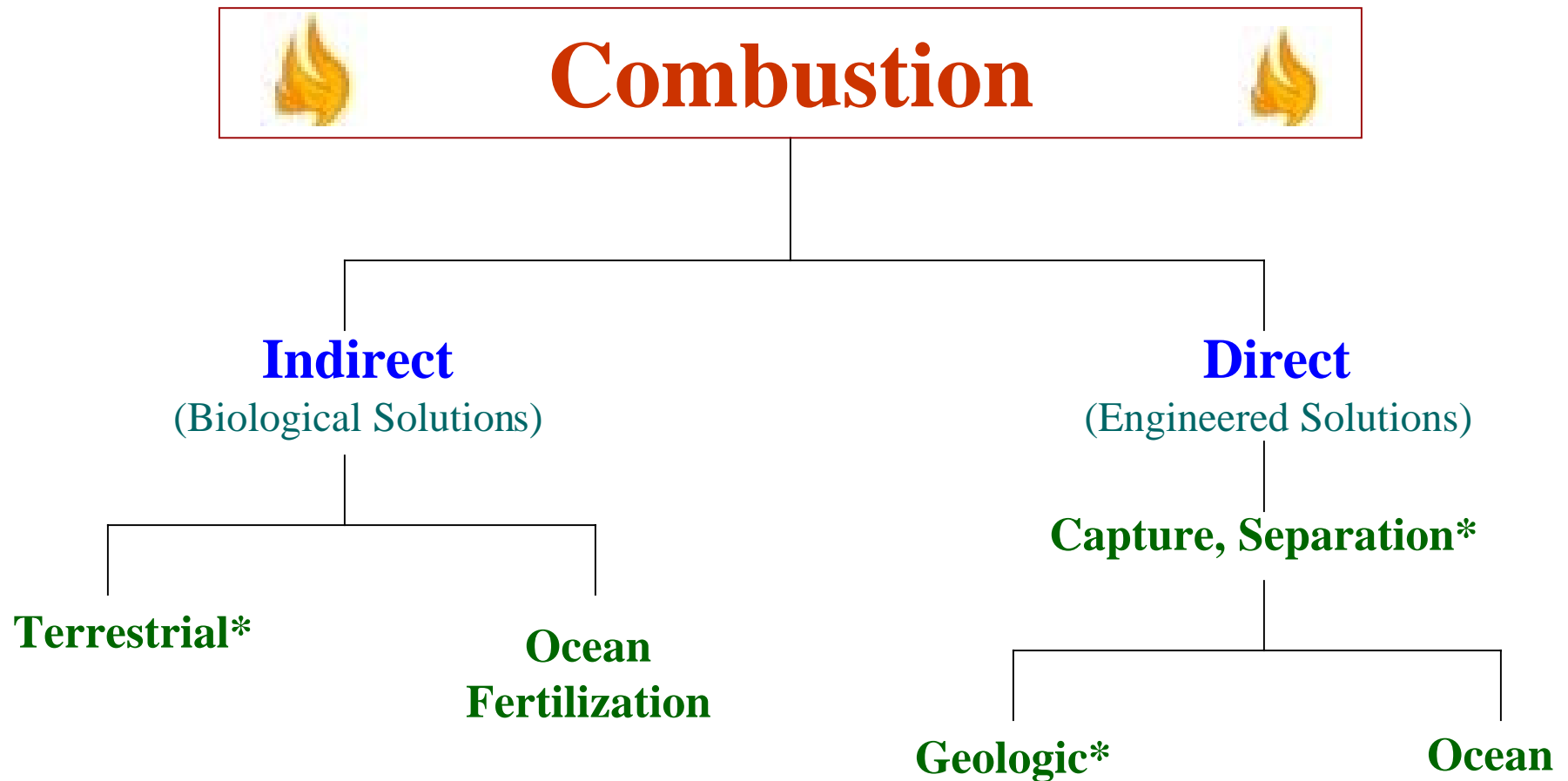
Benefits:

- * Lower NO_x emissions without SCR
- * Allows deployment of smaller turbines for DG
- * Expandable to large, central station turbines
- * Use with Kawasaki turbine





California is Funding Some Carbon Sequestration Activities





Climate Change Research and Assessment Activities are Just Starting



Research center on regional climate change:

- * Focus will be physical sciences and regional modeling
- * Additional studies on ecological and economic impacts





Our Current Portfolio is Being Focused on Regional Center Activities



Project	Amount (\$M)	Contractor/ collaborators
Assessment of impacts of GCC in CA	2.2	EPRI, CDF, CDFA, CDWR
GHG Emission Inventory	0.1	ICF, Transportation Division, Resources Agency, CALEPA
Indirect emissions, metrics, and case studies (three CA entitie s)	0.3	LBNL, Registry, Transportation Division
Carbon market opportunities in CA	0.3	Winrock/EPRI CDF/CDFA
Soil carbon sequestration	0.3	UC/Kearney CDFA
Climate Monitoring, Analyses, and Modeling/Regional Center	1.5	Scripps/UC San Diego, CDWR, NOAA, NS F
Integrated Economic Analyses/Regional Center	1.1	UC Berkeley, NOAA



New Projects are Designed to Address Climate Variability as it May Relate to Climate Change



- ★ Creation of a climatic database for California (late 19th Century to the present)
- ★ Analyses of extreme events to determine trends and develop modeling approaches
- ★ Influence of ENSO and Pacific Decadal Oscillation on California's climate
- ★ Tied to future regional modeling initiatives



Carbon Sequestration in Terrestrial Ecosystems

- * **Forestry related projects:** Winrock, CA Department of Forestry
- * **Agricultural Soils:** Kearney Foundation, CA Department of Food & Agriculture
- * **GIS type of analyses looking at broad scale state-wide opportunities for sequestration**
- * **They will include an estimation of costs and benefits (monetary and environmental)**
- * **Detailed analysis for one county (only for agricultural soils at this time)**



Western Regional Partnership Contains a Coherent Study Unit

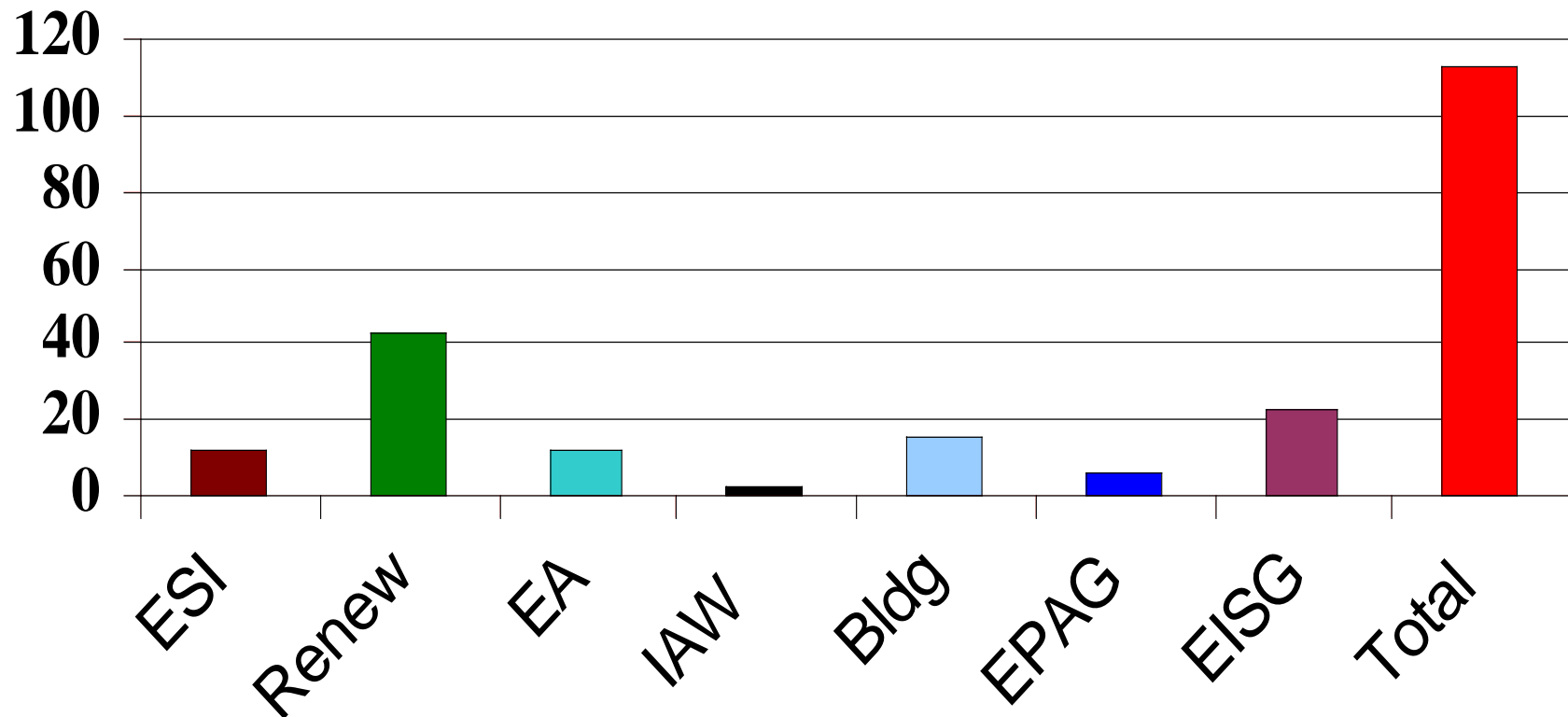


- ★ Commonality in terrestrial sinks in WA, OR, and Northern CA
- ★ Significant CO₂ source - over 11% of US anthropogenic emissions
- ★ Commonality and large potential capacity in geological sinks in CA, NV, and AZ
- ★ Significant potential for offsetting costs with EOR and EGR in California and Alaska North Slope



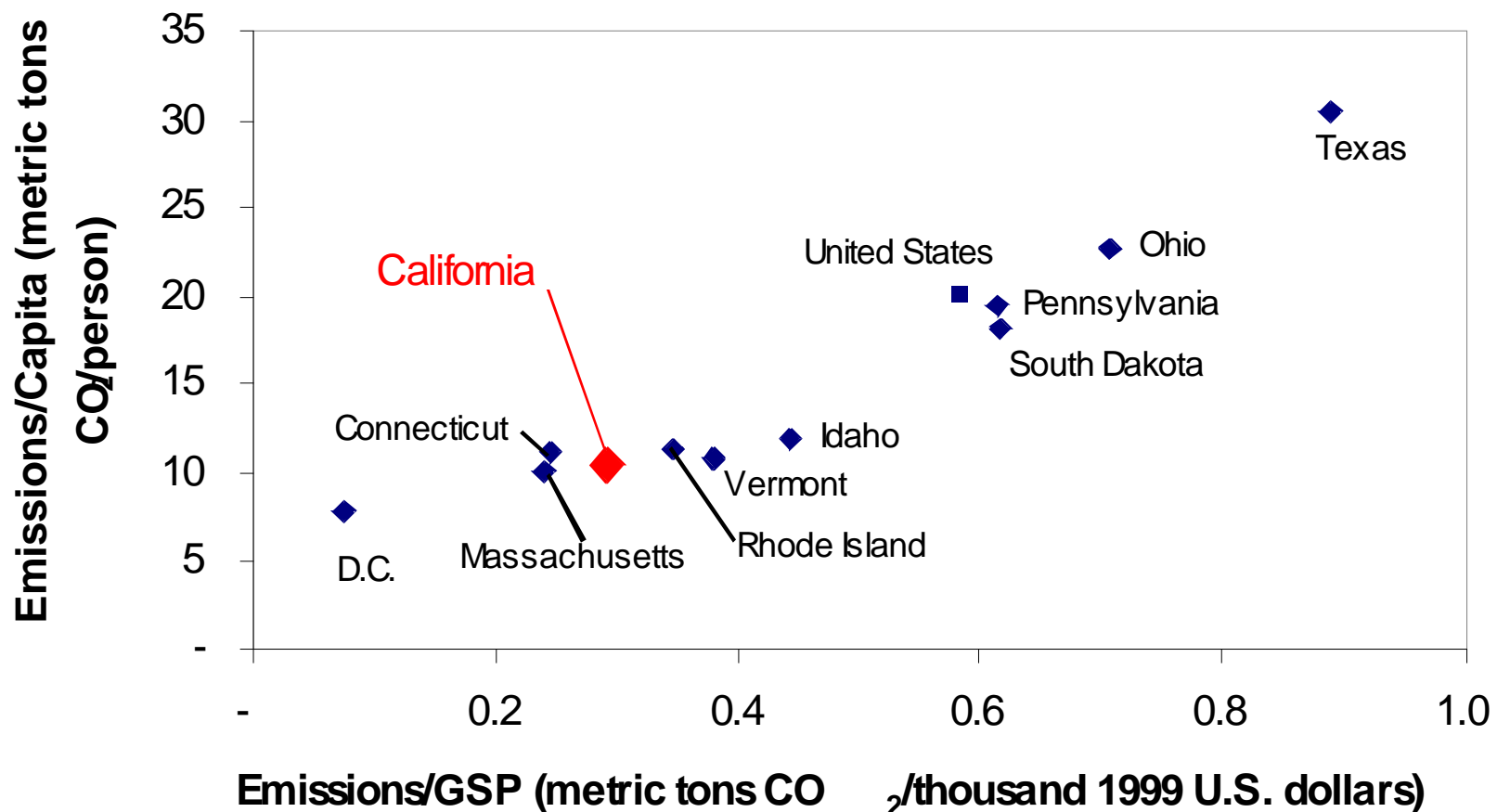


California Must Collaborate with Other Funding Agencies to Improve Chances for Success



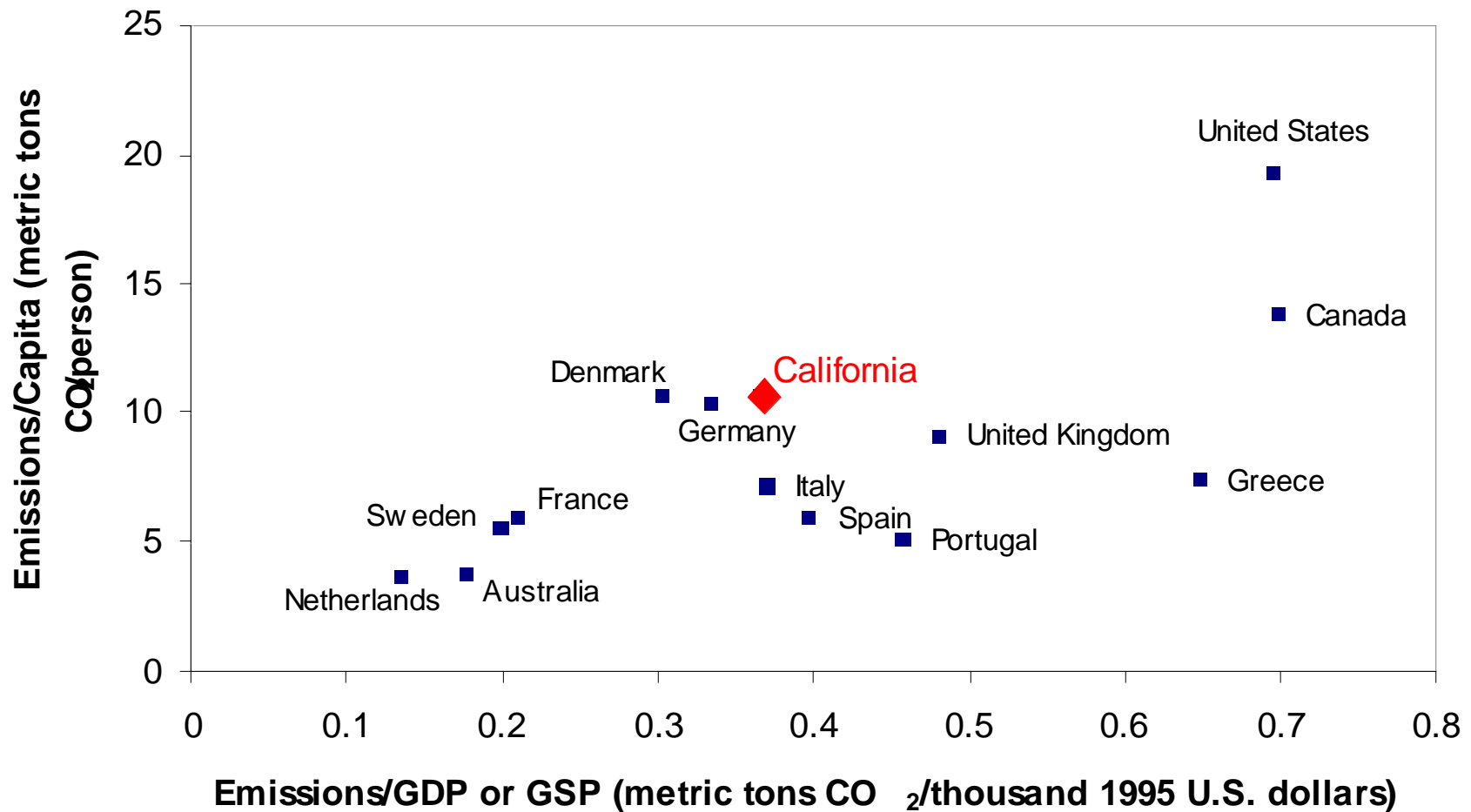


1999 Carbon Intensity from the Combustion of Fossil Fuels for California and Selected States





Carbon Intensities for California and Selected Countries- 1995





California Can Have a Voice in the On-Going Debate

- ★ **Major emitter of greenhouse gases (GHG)**
- ★ **Excellent environmental track record**
 - ▲ energy efficiency and renewables
 - ▲ environmental laws
- ★ **A stream of new policies and programs focused on GHG**
- ★ **An aggressive Public Goods Energy R&D Program for meeting the challenge**



Driving to a Sustainable Future: The “E”s are Linked



- ★ Environment
- ★ Energy
- ★ Economics
- ★ Equity
- ★ Education

